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- (71) Applicant (for all designated States except US): MEDICLEAN CORPORATION LIMITED [GB/GB]; The Moorings, Waterside Business Park, Leeds LS10 1DG (GB).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): HOULBROOK, Kenneth [GB/GB]; Roundhill Farm, Patley Bridge, North Yorkshire HG3 5BN (GB).
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(54) Title: METHOD TO ERADICATE MITES AND TO DENATURE THEIR ALLERGENS

(57) Abstract: The invention provides that textile articles, and especially articles of clothing, are subjected to a steam treatment for such time and to such extent to mites, in particular the house dust mite (HDM) and/or to de-nature the allergen of such mites. Of particular novelty is that the treatment directed to killing the mites and/or de-naturing the allergen, is carried out in conjunction with other treatments which are performed on the textile articles, such as dry cleaning, washing, drying or the like. In the preferred form, the treatment to kill the mites and/or de-nature the allergen is carried out in dry cleaning establishments, and the treatment is carried out in tumble drying equipment whilst the articles are being tumbled.

## METHOD TO ERADICATE MITES AND TO DENATURE THEIR ALLERGENS

This invention relates to the eradication of mites and/or denaturing of their allergens (in particular Der p 1 and Der p 2), for the improvement of living conditions for asthma and the like sufferers, and the invention achieves this in specific and effective ways.

The invention has specific application to the eradication of the house dust mite (HDM) and its allergens which are extremely prevalent in domestic textile articles, specifically carpets and bedding, including mattresses, curtains, chairs, toys and the like. The present invention is also applicable to the eradication of other allergens, such as animal (dog and cat) allergens, and various allergens connected with insects such as cockroaches. As the main application of the present invention is however the HDM and its allergen, reference is made only to such mites hereinafter in the interests of simplicity of description.

The invention represents a breakthrough in relation to the problem that the HDM allergens are the major cause of discomfort to asthma and the like sufferers as evidenced by medical studies (See M J Bluff "Use of Liquid Nitrogen in the Control of House Dust Mite Population" Clinical Allergy, 1986 - volume 16, pages 41 to 47).

The present invention has particular application to the treatment of articles of a portable nature, such as clothing and soft toys, which act as a means for transportation for mites and allergens, and bedding which also constitute breeding grounds for the HDM. The invention in its various aspects is not however to be considered to be limited to such articles. The treatment to which

the invention relates is one whereby the HDM (Dermatophagoides Pteronyssinus) may be killed, and/or allergen contained in its droppings may be de-natured.

The HDM, as its name suggests, inhabits indoor environments, in particular those inhabited by humans or animals. Amounts of microscopic flakes of skin are shed continually by humans or animals, and these flakes not only fall to the floor and onto furnishings in a household, but also accumulate in articles of clothing and toys and the like; the skin flakes will gradually seat within the article. The HDM feeds from these skin flakes as they decompose, and it will be appreciated that where dead skin collects, concentrations of HDM are found. Textiles are particularly susceptible to infestation by HDM since skin particles collect in the spaces between the fibres of the textile, in which spaces the HDMs are able to live and reproduce generally without excess hindrance.

Research has shown that the effects of living in environments free of HDMS, such as hospitals, where few places are found for the HDM to live and breed, is often beneficial to humans with a propensity to develop respiratory problems such as asthma and other diseases such as rinitis and eczema. It is believed that the group of allergens called Der p 1 and Der p 2 (herein "HDM allergen"), associated with the faecal pellets of the mites, is a contributing factor if not a major cause of these diseases. It is believed that the HDM allergen causes an allergic reaction which brings about inflammation of tissue at the surface of the bronchioles in the lungs of an asthmatic person where the allergen comes to rest, where the inflammation causes breathing difficulties.

Methods are known for the treatment of domestic textiles for the eradication of the HDM, and the de-naturing of the allergen, but sufferers of asthma and parents are so fastidious about keeping clear of HDM and the allergen, that they go to great lengths to eradicate the HDM and to de-nature the allergen.

The invention extends the capability to eliminate the HDM and the allergen, and provides various aspects.

The invention extends the capability to eliminate the HDM and the allergen, and provides in one aspect that when clothes are sent to a dry cleaner or laundry for cleaning, they are also subjected to a treatment, which is either the dry cleaning or laundering treatment or both with suitable modification to kill the HDM and/or de-nature the allergen, or are subjected to a separate process for this purpose, so that the clothes are not only dry cleaned or laundered, but are also "mite treated" or similar. The dry cleaning and/or laundering and/or other treatment can be considered as the processing treatment, whilst the other treatment is the "mite treatment".

Where the processing treatment itself involves steaming, it is modified to provide the mite treatment, in that the clothes are subjected to additional steaming in terms of time and/or temperature

A dry cleaners or laundry is an ideal location for the treatment to be carried out, as the processing units will have the necessary equipment to perform the method readily, and if not they will still be suitable locations for providing any necessary additional equipment as may be required, but in any event, they will be ideally situated to advertise that they can also provide a "mite

eradication treatment" which will encourage customers who are allergy sufferers, or who have allergy sufferers within the family.

This aspect of the invention provides a method which enhances a trading method, and make use of existing establishments to provide a considerable benefit to asthma and the like sufferers.

Specifically, at a dry cleaners there is a tumble drier machine, which may also be the dry cleaning machine. The garments are preferably treated in such machine with steam to perform the eradication treatment.

In one example, the garments are dry cleaned, and then immediately or after a delay, they are introduced into the tumble drier machine, and are subjected firstly a pre heat treatment for approximately two minutes during which they are heated to 60 to 65 degrees centigrade, following which the steam is injected into the garments for a short burst in the order of 10 seconds at a pressure of 60 psi, and then the garments and continued to be tumbled in the steam for a post treatment period of approximately 20 secs. This cycle of steam injection and post treatment may be repeated as many times as desired, but it is believed that only two cycles will be needed.

After the steam treatment, the garments may be dried and then allowed to cool, the garments being tumbled all the while.

The steam may be obtained by bleeding the steam from the steam coil when the tumble drier is of the type which has a steam heat exchanger for providing the heat for the usual tumble drying, or if the drier is electric then an additional unit for steam, attached or built into the machine or as a separate unit will be provided.

In another aspect, the invention provides that a tumble drier type machine is provided with the capability of applying steam to articles in the tumble drier, preferably whilst they are being tumbled.

This capability may be provided in any suitable way, including that the tumble drier is provided with an integral steam generator, and an appropriate programme for controlling the supply of steam to articles in the machine. Such control will be such as to vary the time during which the steam is applied, the temperature and dryness at which it is supplied, and when it is supplied in a cycle of operations including at least one other treatment, e.g. tumble drying, to which the articles may be subjected.

It is preferred that the articles be kept dry during the steaming by introducing hot air into the machine, as would be normal for the tumble drying of the articles if the machine were to be used for tumble drying.

Again, the steam may be provided by adapting an existing tumble drier to receive steam from a separate steam generation unit, but again the appropriate controls for varying time, temperature and dryness would be provided.

The articles which would be treated in this way would be ones capable of being inserted into the tumble drier, and would typically be clothes and soft fabric articles, such as toys. In the latter case, the tumble drier may be provided with a support for the toys so that they are held in predetermined position in the machine as steaming is taking place. For example, the support may be a basket in which the toys or the like are held, and the steam is arranged to be injected into the basket to treat the toys.

In another case, the support may comprise one or more spikes through which steam can be supplied, the toy or toys being impaled on the spike or spikes. The steam is injected into the toy or toys through the spike or spikes to treat the toy or toys from the inside, which is an extremely effective way of killing and denaturing deep seated mites and allergens. This idea is covered by European Patent Application No. 95922669.7. The support can take many forms. For example the support can be front loaded into the machine and the steam can also be adapted to be injected from the front of the machine, the loading door being adapted if needed for this purpose.

The steam treatment in a tumble drier need not be accompanied by other treatments such as heating with hot air, but hot air is preferred to keep the environment dry. If there is condensation in the machine, this can be dealt with by collection and removal. The collected condensate can be recycled.

In another form of treatment according to the invention, a former, such as an air and steam pressing former, to which articles such as clothes can be fitted is provided with a means of applying steam to the articles after they have been so fitted, the steam treatment being for a period sufficient to de nature the allergens and/or kill the mites in the manner indicated in the Earlier Application. Preferably, the steam is passed through the article from the inside to out

In the case of using steam, it will be appreciated that the steam has to be applied for a sufficient length of time to be effective in killing at least most of the mites, and/or de naturing of the allergens.

In experiments it has been indicated that there may be an advantage treating the articles with steam whilst they are still cold, or that is to say the articles need not be pre-heated before being contacted with the steam.

Also, it may be advantageous to use additives such as citrus oil in the treatment. Such additives may be instrumental in assisting the killing of the mites and the de naturing of the allergens, and/or they may be included for fragrance purposes. Such additives may be applied before or after the application of steam.

In a specific application of the invention, a tumble drier was modified to accept a steam nozzle from which steam could issue. The nozzle was mounted at the rear of the machine, and was located close to the rear plate of the machine drum so that steam issuing from the nozzle passed at any one time through several of the holes in the drum plate through which the hot air normally passes, the hot air simultaneously passing through the remaining holes. As the drum rotated, so the steam passed through different ones of the holes, the steam nozzle being stationary.

The unit for providing the steam comprised a boiler with controls and was of a similar nature to that disclosed in the abovementioned European Patent Application, but any suitable form of steam unit could be employed.

The tumble drier machine could be an industrial machine or a domestic machine, as required.

In another adaptation of the invention, there is provided a steaming unit in the form of a vacuum cleaner, which has the dual capability of vacuuming carpets, but also has a steam generating means and a steam outlet which is provided with a



nozzle adapting the nozzle for insertion into a core region of an article to be treated with steam in the manner set forth above.

Details of an actual test are given below.

Test using a modified tumble drier.

A tumble drier was modified as above so that steam could be injected into the drum whilst the drum was rotating.

Four Cotton overalls were tested.

Dust from mite infested mattresses was collected from a vacuum cleaner used to vacuum the mattresses, and pairs of small samples of 2mg were taken and put into small bags made from mite barrier material to provide a test sample bag and a corresponding control sample bag.

Four tumble dry/steam tests were carried out.

In each test, two test sample bags were put into the pockets of the garment, and the two control samples were identified for comparison. After each test, the test samples were removed from the garments, and the test samples and their control samples were put to one side for subsequent measuring.

In each test, the garments were put into the tumble drier, and with the drum rotating, were subjected to the following treatments.

Test 1

Steaming 2 minutes followed by Hot Air Heating 5 minutes.

Test 2.

Steaming 6 minutes followed by Hot Air Heating 5 minutes.

Test 3.

Heating 5 minutes followed by Steaming 2 minutes followed by Hot Air Heating 5 minutes

Test 4.

Heating 5 minutes followed by Steaming 6 minutes followed by Hot Air Heating 5 minutes

The amount of mites and allergens in the test sample after the test and the corresponding control sample were compared, and in each case a substantial reduction in the mites and allergens was observed. The results also indicated that the absence of the pre-heating step in Tests 3 and 4 gave better results.

The present invention can be practised at for example a dry cleaning organisation, to provide that the garments and other articles can be treated for mites and allergens, and this can be as part of the dry cleaning service, or as a separate service. Alternatively, the equipment can be for domestic use, and tumble driers, either dedicated or as part of a washing machine can be used for the purpose.

At some dry cleaning establishments, where for example more specialized garments, such as wedding dresses are dry cleaned, there are other machines such as steaming tunnels, and the process of the invention may be carried out in such a steaming

tunnel, which is a long chamber through which the articles to be treated move whilst being treated. This has the advantage that the articles can be kept isolated in a sterile atmosphere.

Where the invention is utilised in conjunction with dry cleaning, the invention may be practised before or after the dry cleaning operation has been performed on the articles(s). Some general tests have shown that carrying out the method of the invention after the dry cleaning can be of advantage.

Also, vacuum cleaners can be used for steam injection into article to be treated.

Preferably, in the invention, the clothes or other articles are subjected to steaming treatment in terms of time and/or temperature to provide the effect of the killing all of the HDM and/or the de-naturing of all the allergens, which does not at present happen for example in conventional treatments where steam is used. By the word "all" is to be understood that the processing treatment results in the killing of a substantially greater number of the HDM, or the de-naturing of a substantially greater proportion of the allergen than would currently be achieved with conventional dry cleaning or laundering, and is not intended to limit the invention to 100% killing or denaturing of HDM or allergens.

Alternatively, or in addition, the processing treatment may be modified by the addition of a chemical having the characteristic of being able to kill the HDM and/or de-nature the allergen. Tannic acid is one such chemical, and Benzyl Benzoate is another. Any suitable quantity of either or both of such chemicals may be added.

The clothes may be subjected to a pre-treatment and/or a post treatment for the purposes of the invention.

A dry cleaners or laundry is an ideal location for the treatment to be carried out, as the processing units will have the necessary equipment to perform the method readily, and if not they will still be suitable locations for providing any necessary additional equipment as may be required, but in any event, they will be ideally situated to advertise that they can also provide a "mite eradication treatment" which will encourage customers who are allergy sufferers, or who have allergy sufferers within the family.

This aspect of the invention provides a method which enhances a trading method, and make use of existing establishments to provide a considerable benefit to asthma and the like sufferers.

## Claims

1. A method of processing of textile articles which comprises two stages one of which is washing, cleaning drying or pressing of the articles and the other of which is the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles.
2. The method according to claim 1, wherein the stages take place in sequence.
3. The method according to claim 2, wherein the stages take place in a tumble drier machine and the stages are tumble drying the articles, and the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles.
4. The method according to claim 3, wherein the tumble drier machine is a domestic tumble drier which has the facility to effect the steam treatment
5. The method according to claim 2, wherein the stages take place in a dry cleaning establishment, and the stages are dry cleaning and the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles.
6. The method according to claim 5, wherein the steam treatment is effected after a dry cleaning process.
7. The method according to claim 6, wherein the steam treatment process is effected in a tumble drying machine

8. The method according to claim 7, wherein the steam treatment process comprises injecting steam into the garments whilst they are being tumbled
9. The method according to claim 8, wherein the steam is injected into the garments for a short burst
10. The method according to claim 9, wherein the short burst is for a period in the order of 10 seconds.
11. The method according to claim 9 or 10, wherein after the short burst, the garments are tumbled in the presence of the steam for a delay interval.
12. The method according to claim 11, wherein the delay interval is in the region of 20 seconds.
13. The method according to claim 9 or 10 wherein the cycle of short burst and delay interval is repeated.
14. The method according to any of claims 5 to 13, wherein the garments are heated for a pre heat period before being steam treated.
15. The method according to claim 14, wherein the pre heat period is approximately two minutes
16. The method according to claim 15, wherein the garments are pre heated to a temperature in the region of 60-65 degrees centigrade.
17. The method according to claim 1, wherein the stages take place simultaneously.

18. The method according to claim 6 or any claim dependent thereon, wherein the stages take place in a cleaning establishment, and the stages comprise steam cleaning and the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles.
19. The method according to claim 6 or any claim dependent thereon, wherein the steam cleaning and the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles takes place in a steaming tunnel.
20. The method according to claim 1 or 2, wherein the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles takes place in a steaming tunnel.
21. The method according to claim 1 or 2, wherein the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles takes place in a pressing former.
22. The method according to any preceding claim, wherein the stage comprising the use of steam for the killing of, and/or the de naturing of allergens of, mites in textile articles, is carried out on the articles whilst they are at ambient temperature.

# INTERNATIONAL SEARCH REPORT

International Application No

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**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 A61L2/07

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 03870 A (HOULBROOK KENNETH) 15 February 1996 (1996-02-15) page 7, line 29 - line 32 page 8, line 28 - line 34 page 18, line 1 - line 31 ---	1-22
A	GB 1 026 351 A (BRIAN BACH ET AL.) the whole document -----	1



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Diederer, J



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/03057

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9603870 A	15-02-1996	AU 687212 B AU 2749095 A CA 2195978 A EP 1043032 A EP 0773717 A	19-02-1998 04-03-1996 15-02-1996 11-10-2000 21-05-1997
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